

Change of Physicochemical Properties after Cold Water Irrigation in Japonica rice

Ki-Young Kim^{}**, Yoon-Hee Choi^{*}, Mun-Sik Shin^{*}, Bo-Kyeong Kim^{*}, Jin-Il Choung^{*},
Jae-Kweon Ko^{*}, Jung-Gon, Kim^{*}

** Honam Agricultural Research Institute, NICS, RDA, Iksan 570-080, Korea*

Objectives

This experiment was conducted to get the useful information on major changes of factors associated with physicochemical properties after cold water stress.

Materials and methods

Six Japonica rice varieties and lines selected through cold water treatment in 2003 (Table 1) were used to examine major changes of factors associated with physicochemical properties after cold water stress. Cold water treatment($19^{\circ}\text{C}\pm 2$) was performed from 30 days after transplanting to heading date. Six varieties and lines were harvested after 45 days heading date and these seeds adjusted as 15% water content. These varieties and lines's seeds were milled using milling machine(Satake; THV, Yamamoto, Japan). Protein content and amylose content of milled rice, and fatty acid of brown rice were analyzed using AN-700(Near-infrared grain Test, Japan). Magnesium and potassium content were measured by NIRs(6,500, USA). Alkali digestibility was determined in visual by Little's(1958) scale(1-7) of spreading and clearing of milled rice kernel soaked in 1.4% KOH solution during 23 hours at constant temperature of 30°C . Mechanical eating score was measured by MIDO meter(MA-90B, Toyo, Japan).

Results and Discussion

This study was focused on the change of physicochemical properties of rice treated with cold water irrigation. Contents of total protein, amylose, and fatty acids after cold water irrigation were increased in brown or milled rice. Magnesium and potassium content was decreased in all varieties and lines after cold water irrigation. The balance of Mg and K also plays an important role in eating quality. But, Mg/K ratio after cold water irrigation was not different, comparing with control condition. Alkali digestion value(ADV) was increased and mechanical eating score was decreased.

Table 1. Changes of physiochemical properties, Alkali digestion value(ADV), and mechanical eating score after cold water irrigation.

Varieties/line	Protein contents (%)					
	Brown rice			Milled rice		
	C	T	I	C	T	I
HR19621-AC6	7.3±0.2	8.9±0.6	17.0±2.8	6.8±0.0	8.3±0.5	18.2±5.2
Sambaegbyeo	7.0±0.2	8.5±0.1	17.7±1.3	6.5±0.4	8.0±0.3	18.0±7.9
Unbong31	6.3±0.2	7.6±0.2	16.7±0.0	6.0±0.4	7.1±0.1	15.9±4.4
Hitomebore	6.9±0.2	7.8±0.3	11.9±0.7	6.6±0.4	7.7±0.1	14.9±4.2
Jinbubyeo	7.4±0.1	8.1±0.2	8.8±1.2	7.1±0.1	7.6±0.1	6.8±1.0
Stejaree45	7.5±0.2	8.4±0.1	10.7±1.3	6.5±0.1	7.2±0.2	10.4±3.3
Mean	7.1^{b**}	8.2^a	13.8	6.6^{b**}	7.7^a	14.0
LSD (5%)	0.3	0.7	4.2	0.5	0.7	ns

Varieties/line	Amylose contents (%)					
	Brown rice			Milled rice		
	C	T	I	C	T	I
HR19621-AC6	19.1±0.0	19.2±0.2	0.5±1.0	18.0±0.1	18.0±0.0	0.2±0.3
Sambaegbyeo	19.0±0.0	19.3±0.2	1.2±1.2	18.3±0.0	18.2±0.0	-0.6±0.1
Unbong31	19.0±0.0	19.4±0.2	1.9±1.2	18.2±0.0	18.2±0.0	-0.1±0.4
Hitomebore	19.2±0.0	19.3±0.0	0.4±0.4	18.5±0.0	18.4±0.1	-0.5±0.5
Jinbubyeo	19.2±0.0	19.2±0.0	0.0±0.0	18.1±0.0	18.3±0.2	0.6±0.9
Stejaree45	18.9±0.1	19.1±0.0	0.7±0.7	17.6±0.1	17.6±0.1	0.1±0.9
Mean	19.0^{b*}	19.2^a	0.8	18.1^{ns}	18.1^{ns}	0
LSD (5%)	0.2	ns	ns	0.15	0.27	ns

Varieties/line	Fatty acids contents (%)			K (ppm)			Mg (ppm)		
	C	T	I	C	T	D	C	T	D
	HR19621-AC6	15.9±0.3	16.9±0.0	5.7±1.7	1917±25.3	1818±32.3	5.5±0.5	580±0.1	547±38.0
Sambaegbyeo	16.6±0.2	16.9±1.2	6.0±1.5	1650±2.8	1618±46.2	2.0±2.7	500±18.8	450±28.4	11.3±2.8
Unbong31	15.5±0.4	17.2±0.6	10.0±0.9	1867±18.7	1742±28.6	7.2±0.7	539±21.0	472±6.2	14.3±3.0
Hitomebore	17.3±0.0	17.8±0.4	2.4±2.1	1625±31.1	1533±63.9	2.7±1.5	446±0.6	408±0.4	9.4±0.0
Jinbubyeo	16.8±0.2	16.9±0.5	1.1±1.5	1889±51.9	1822±26.7	3.7±4.4	557±17.2	515±22.2	8.2±8.0
Stejaree45	13.7±0.3	14.7±0.0	6.9±2.4	1911±7.0	1833±6.0	4.3±0.7	544±5.4	513±2.8	6.1±1.6
Mean	16.0^{b**}	16.7^a	5.4	1809.8^{**}	1735.8^b	4.2	527.8^{**}	480.9^b	9.9
LSD (5%)	0.6	1.6	4.5	67.7	79.2	ns	30.2	43.5	ns

Varieties/line	Mg/K (mEq/mEq)			ADV(1-7)			Mechanical eating score		
	C	T	D	C	T	I	C	T	D
	HR19621-AC6	0.97±0.01	0.93±0.03	4.4±2.4	5.3±0.1	5.7±0.1	7.1±2.4	69.9±2.5	56.8±0.7
Sambaegbyeo	0.98±0.04	0.90±0.08	9.1±5.7	5.4±0.1	5.9±0.1	8.5±0.2	82.0±1.2	71.7±0.9	14.4±0.2
Unbong31	0.81±0.02	0.87±0.03	-6.7±0.6	6.0±0.0	6.6±0.3	6.3±0.0	81.8±0.8	71.6±0.1	14.2±1.3
Hitomebore	0.81±0.01	0.83±0.00	-2.6±1.5	6.0±0.0	6.2±0.3	5.5±1.1	85.3±2.0	81.4±3.2	4.9±1.7
Jinbubyeo	0.88±0.01	0.91±0.05	-3.5±4.1	5.2±0.3	5.9±0.3	11.9±0.6	74.6±2.9	72.9±3.1	2.3±0.4
Stejaree45	0.89±0.04	0.90±0.00	-1.7±4.0	6.0±0.1	6.1±0.4	4.0±1.1	69.5±0.2	61.0±1.4	13.9±2.3
Mean	0.89^{ns}	0.89^{ns}	-0.2	5.6^{b**}	6.1^a	7.2	77.1^{**}	69.2^b	12.1
LSD(5%)	0.06	ns	9.5	0.36	0.38	3.3	3.0	5.0	6.8

C : Control, T : Treatment, I : Increasing ratio(%) : [100-(Control/Treatment)×100]

D : Decreasing ratio(%) : [100-(Treatment/Control×100)]